

Chapter 1

Introduction

Successful biosolids land application programs should have provisions to deal with daily biosolids production in the event biosolids cannot be land applied immediately. This contingency planning generally includes storage as well as other back-up options, such as landfill disposal, incineration or alternative treatment and use, including composting, heat drying and advanced alkaline stabilization.

Storage is necessary during inclement weather when land application sites are not accessible and during winter months when land application to snow covered and frozen soil is prohibited or restricted. Storage also may be needed to accommodate seasonal restrictions on land availability due to crop rotations or equipment availability. For small generators, storage allows accumulation of enough material to efficiently complete land application in a single spreading operation. Well-planned and managed storage options not only provide operational flexibility at the treatment facility, but they also can improve the agronomic, environmental, and public acceptance aspects of biosolids use.

The focus of this document is on management practices for field storage of biosolids prior to land application, as distinguished from land application and spreading. The document stresses recommended management practices for three critical control points: the WWTP, the transportation system, and the field storage site. The term critical control point, as used in this document, means a location, event or process point at which specific monitoring and responsive management practices should be applied. If these points are controlled, the objectives and goals of a responsible and community-friendly practice can be achieved. Equally important is the continuing need for partnership and good communication among biosolids generators, storage site managers and land appliers.

The term field storage as used in this document refers to temporary or seasonal storage. Storage operations involve an area of land or facilities constructed to hold biosolids until material is land applied on designated and

approved sites. More permanently constructed storage facilities can involve state or locally permitted areas of land or facilities used to store biosolids. The permissible time limits for field storage vary by state and local jurisdiction. They are usually located at or near the land application site, and are managed so that biosolids come and go on a relatively short cycle, based on weather conditions, crop rotations, and land or equipment availability. Alternatively, storage sites are used to accumulate enough material to conduct an efficient spreading operation. Some of the terminology frequently used to describe is shown in the box below. The terminology, as well as associated prescribed limits on field storage, can vary from state to state. Definitions of these and other specialized terms that appear elsewhere in this document (as individual bold typeface), and abbreviations can be found in the Glossary (Appendix F).

It is very clear to all biosolids generators, transporters, storers, land appliers, and local officials that malodors are the greatest reason for public concern about storage sites. Much of this guidance document seeks to provide information and strategies useful in minimizing odor problems.

Frequently Used Field Storage Terminology

Staging	Field placement of biosolids at the time of delivery in such manner as to facilitate land-application the same day or within a few days; may also involve transfer of biosolids from transport vehicles to equipment for immediate land application.
Stockpiling	Holding of biosolids at an active field site long enough to accumulate sufficient material to complete the field application efficiently.
Field storage	Temporary or seasonal storage area, usually located at the application site, which holds biosolids destined for beneficial use on designated fields. State regulations may or may not distinguish between staging, stockpiling or field storage. Time limits for storage range from 24 hours to two years, depending on the jurisdiction in which it is located.
Storage Facilities	An area of land or constructed facilities committed to hold biosolids until the material may be land applied at on- or off-site locations. This facility may be used to store any given batch of biosolids for up to two years. However, most are managed so that biosolids come and go on a shorter cycle based on weather conditions, crop rotations and land availability, equipment availability, or to accumulate sufficient material for efficient spreading operations.

The types of biosolids discussed in this document include Class A and Class B (classes indicate the degree of pathogen reduction, see Chapter 4). These biosolids are produced by treatment processes that generate liquid, dewatered, heat dried, air-dried, composted, digested, or alkaline stabilized materials. The type and intensity of the treatments varies and this impacts the properties of the biosolids that are placed in storage. Thus, each site should be designed to adequately handle the types of materials expected. The operations management plan should be matched to the properties of the designed site and the type of biosolids being stored.

Management for Storage

This section explains some of the general principles underlying the management of biosolids in storage situations. Biosolids managers should keep these concepts in mind as they assess their storage needs and options and develop a management plan suited to their unique situation.

Critical Control Points (Key Management Areas)

Even with a wide variety of biosolids and the numerous types of field situations that are encountered throughout the U. S., all field storage operations can be broken down into three areas that are critical for good management: the biosolids generating facility, transportation, and the actual field storage site (see box below). Activities in each of these areas are critical to the overall success of biosolids storage operations. For instance, the level of treatment and post-treatment handling at the generating facility may affect the odor characteristics once biosolids reach the field site.

CRITICAL CONTROL POINT 1: WWTP
CRITICAL CONTROL POINT 2: TRANSPORTATION PROCESS
CRITICAL CONTROL POINT 3: FIELD STORAGE SITE

This guide provides detailed descriptions of the practices recommended for management of these areas as well as explanations of their importance relative to odors, water quality, pathogens and community acceptance. Biosolids managers are encouraged to carefully analyze their own particular situations and select the most feasible combination of practices for their unique situation from this guide.

Table 1.1 highlights the main issues and some of the self-monitoring activities and control options involved in each of these management areas. Complete descriptions of these practices are provided in subsequent chapters.

Variables Related to Intensity of Management

There are five variables that affect the level or intensity of management required for successful field storage of biosolids.

1. Stability of Biosolids: Material that is less well stabilized generally has a greater potential to generate unacceptable levels of odorous compounds.
2. Water Content of Biosolids: Liquid and some semi-solid material require pumping equipment and constructed storage facilities.
3. Length of storage period: Longer storage periods increase the potential for exposure to wet or hot weather and a resumption of microbial decomposition leading to the generation of odorous compounds.
4. Volume of stored material: Management requirements in terms of site design, operation and the potential scale of odor or water quality impacts may increase with the volume of material stored.
5. Climate and weather conditions: Warm humid weather or wet conditions generally increase management requirements as compared to storage during dry or cold conditions.

The preceding variables are interrelated and therefore exceptions to particular points may occur when mitigated by other variables. For instance, a large volume of a well-stabilized biosolids may be less management intensive in terms of preventing nuisance odors, than the storage of a small volume of a less well-stabilized material. Figure 1.1 provides a schematic to illustrate several of these interrelated factors. Throughout this guide, the diagram will be used to highlight the importance that the interaction of these factors has on the overall success of biosolids storage operations.

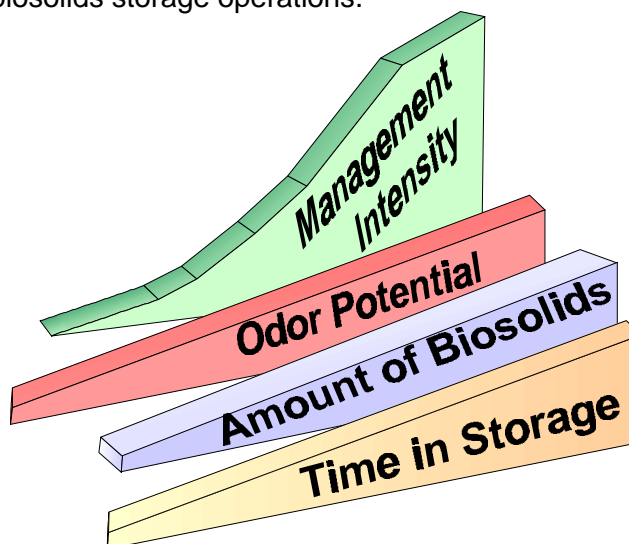


Table 1-1. Overview of Management Control Points for Field Stored Materials*

Issues	Self-Monitoring Checklist	Control Options
1 Biosolids Generating Facility		
<ul style="list-style-type: none"> • Odors and aesthetics • Consistency of biosolids • Biosolids treatment 	<ul style="list-style-type: none"> • Assess biosolids to determine: • 503 treatment criteria for pathogens and VAR • Degree of stability and odor potential includes factors such as volatile solids content; lime, polymer and iron usage, and pH • Physical consistency • Ratio of primary to secondary • Cleanliness of equipment • Time of retention after treatment 	<ul style="list-style-type: none"> • Generator, storer and land applier communicate about status of biosolids treatment or problems • Reduce post-treatment retention • Have options to divert unacceptable loads • Reevaluate treatment and handling practices to address chronic issues • Provide further treatment • Provide vehicle cleaning station
2. Transportation		
<ul style="list-style-type: none"> • Odors and aesthetics • Traffic and safety 	<ul style="list-style-type: none"> • Proper equipment in compliance with State and Federal Transportation Regulations • Regular inspections and maintenance of vehicles and equipment • Suitable haul routes • Vehicles and equipment kept clean 	<ul style="list-style-type: none"> • Train drivers • Plan/inspect haul routes, minimize time in transport • Emergency spill plan and supplies in place • Maintain and clean trucks and equipment regularly
3. Field Storage Site		
<ul style="list-style-type: none"> • Odors and aesthetics • Water quality and environmental protection • Safety and health protection 	<ul style="list-style-type: none"> • Proper site location & suitability • Proper design of field storage or constructed facility <ul style="list-style-type: none"> - run-on and run-off controls - accumulated water control - buffers • Biosolids quality vs length & amount in storage • Operations and maintenance plan • Odor prevention and mitigation plan • Spill control and response plan • Safety plan 	<ul style="list-style-type: none"> • Regular self inspections of site and operations • Consistent implementation of management plans • Self monitoring of biosolids quality and condition • Revision of management plans when necessary <ul style="list-style-type: none"> - change amount or length of storage - implement odor control and mitigation measures - implement additional structural or site management practices • Remove stored biosolids when atmospheric conditions are conducive to low odor impacts on neighbors

*See Chapter 5 for recommendations for specific facility/storage options.

Need for Partnerships



It is recognized by experienced biosolids management teams that partnership and good communication between the biosolids generator and the biosolids manager responsible for storage and land application is essential to optimizing the management of biosolids destined for storage. Successful storage programs require coordination of management activities at the generating facility, in transit and at the storage site.

Likewise, good communication links are necessary between the biosolids manager and the biosolids users, local governments, and citizens of communities where biosolids storage activities are located. Chapter 6 discusses methods to establish and enhance communication links between biosolids managers and communities.

The absence of such partnerships has often resulted in odors or other problems with subsequent unfavorable community acceptance, political, or economic consequences. Land applicators overwhelmed with community relations problems may be forced to cease land application and seek alternative management options. These are typically more costly to consumers than field storage and land application, or result in lost economic and environmental benefits to farmers, landowners, and diversion of biosolids to non-beneficial uses, such as land filling or incineration.



Figure 1-1. Successful biosolids storage programs begin with good communications between biosolids generators and haulers. Pro-active communication and interaction among generators, field operation managers, and neighboring communities facilitate the success of beneficial use programs.



Figure 1-2. Good site selection and field management practices ensure that field stockpiles can be used during several seasons (Courtesy of King County, WA, Dept. Natural Resources in cooperation with Boulder Park, Inc)

